

# Chemistry

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(Chapter - 3) (Chemical Kinetics) (Exercises)  
(Class 12)

## Question 3.1:

From the rate expression for the following reactions, determine their order of reaction and the dimensions of the rate constants.



### Answer 3.1:



Therefore, order of the reaction = 2

$$\text{Dimension of } k = \frac{\text{Rate}}{[\text{NO}]^2} \Rightarrow \frac{\text{mol L}^{-1}\text{s}^{-1}}{(\text{mol L}^{-1})^2} = \frac{\text{mol L}^{-1}\text{s}^{-1}}{\text{mol}^2\text{L}^{-2}} = \text{L mol}^{-1}\text{s}^{-1}$$



Therefore, order of the reaction = 2

$$\text{Dimension of } k = \frac{\text{Rate}}{[\text{H}_2\text{O}_2][\text{I}^-]} \Rightarrow \frac{\text{mol L}^{-1}\text{s}^{-1}}{(\text{mol L}^{-1})(\text{mol L}^{-1})} = \text{L mol}^{-1}\text{s}^{-1}$$



Therefore, order of reaction = 3/2

$$\text{Dimension of } k = \frac{\text{Rate}}{[\text{CH}_3\text{CHO}]^{3/2}} \Rightarrow \frac{\text{mol L}^{-1}\text{s}^{-1}}{(\text{mol L}^{-1})^{3/2}} = \frac{\text{mol L}^{-1}\text{s}^{-1}}{\text{mol}^{3/2}\text{L}^{3/2}} = \text{L}^{3/2}\text{mol}^{1/2}\text{s}^{-1}$$



Therefore, order of the reaction = 1

$$\text{Dimension of } k = \frac{\text{Rate}}{[\text{C}_2\text{H}_5\text{Cl}]} \Rightarrow \frac{\text{mol L}^{-1}\text{s}^{-1}}{\text{mol L}^{-1}} = \text{s}^{-1}$$

## Question 3.2:

For the reaction:



The rate =  $k[\text{A}][\text{B}]^2$  with  $k = 2.0 \times 10^{-6} \text{mol}^{-2}\text{L}^2\text{s}^{-1}$ . Calculate the initial rate of reaction when  $[\text{A}] = 0.1 \text{mol L}^{-1}$ ,  $[\text{B}] = 0.2 \text{mol L}^{-1}$ . Calculate the rate of reaction after  $[\text{A}]$  is reduced to  $0.06 \text{mol L}^{-1}$ .

### Answer 3.2:

The initial rate of reaction is

$$\text{Rate} = k[\text{A}][\text{B}]^2 \Rightarrow (2.0 \times 10^{-6} \text{mol}^{-2}\text{L}^2\text{s}^{-1})(0.1 \text{mol L}^{-1})(0.2 \text{mol L}^{-1})^2 = 8.0 \times 10^{-9} \text{mol}^{-2}\text{L}^2\text{s}^{-1}$$

When  $[\text{A}]$  is reduced from  $0.1 \text{mol L}^{-1}$  to  $0.06 \text{mol L}^{-1}$ ,

$$\text{The concentration of A reacted} = (0.1 - 0.06) \text{mol L}^{-1} = 0.04 \text{mol L}^{-1}$$

$$\text{Therefore, concentration of B reacted} = \frac{1}{2} \times 0.04 \text{mol L}^{-1}$$

$$\text{Then concentration of B available, } [\text{B}] = (0.2 - 0.02) \text{mol L}^{-1} = 0.18 \text{mol L}^{-1}$$

After  $[\text{A}]$  is reduced to  $0.06 \text{mol L}^{-1}$ , the rate of reaction is given by,

$$\text{Rate} = k[\text{A}][\text{B}]^2 \Rightarrow (2.0 \times 10^{-6} \text{mol}^{-2}\text{L}^2\text{s}^{-1})(0.06 \text{mol L}^{-1})(0.18 \text{mol L}^{-1})^2 = 3.89 \text{mol L}^{-2}\text{s}^{-1}$$

## Question 3.3:

The decomposition of  $\text{NH}_3$  on platinum is zero order reaction. What are the rates of production of  $\text{N}_2$  and  $\text{H}_2$  if  $k = 2.5 \times 10^{-4} \text{mol}^{-1}\text{L s}^{-1}$ ?

### Answer 3.3:

The decomposition of  $\text{NH}_3$  on platinum surface is represented by the following equation.



# Chapter 12 Chemistry Solutions Manual

**JL Elias**



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